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there are several lantern slides illustrating the laboratory buildings of the world. The system of classification is thus made elastic.

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*THE NEW CATALOGUE OF CHIROPTERA
IN THE BRITISH MUSEUM*

DURING the past twenty-five years the study of recent mammals has been pursued with an activity unprecedented in the history of other groups of vertebrates. Collections aggregating hundreds of thousands of specimens have been brought together, mostly by three or four museums, and the number of known forms whose existence was previously unsuspected has increased so rapidly that only a few specialists are fully aware of what has been taking place.¹ The trustees of the British Museum have recently issued the first volume of a second edition of the Catalogue of Chiroptera.² This is the first monographic treatment of a large group of mammals in which the systematic activities just alluded to are adequately summarized. Its interest is therefore twofold: to systematists an account of the technical matter which it contains, and to general zoologists as the first definite indication of the extent to which currently accepted ideas regarding the world's mammal fauna must be revised.

The volume now issued, containing more than 900 pages, is by Mr. Knud Andersen, who has spent nearly seven years in its preparation. It deals with the Megachiroptera, the old world fruit-bats, only. No group of mammals has ever been treated in such detail, and it is doubtful whether any work of similar size on any group of vertebrates contains so large and so well arranged a mass of original

¹ The field work which has led to this result was made possible by the invention of several types of small traps, not originally intended for scientific purposes.

² "Catalogue of the Chiroptera in the Collection of the British Museum," second edition, by Knud Andersen. Vol. I., Megachiroptera. London, printed by order of the trustees, etc., 1912. Actual date of publication, March 23, 1912.

observations. The number of forms recognized is 228, distributed among 38 genera and subgenera. These are represented in the British Museum by 1,470 specimens and all but 21 of the species and subspecies.³ In the first edition of the catalogue (Dobson, 1878) the Megachiroptera occupy 98 pages, with 78 forms and 13 genera and subgenera, represented by 425 specimens. This increase of nearly 300 per cent. is probably less than may be expected among the "insectivorous" bats (Microchiroptera). Mr. Andersen's studies of the Microchiropterine genus *Rhinolophus* resulted in an increase of from 21 to 105 or more, while his "Monograph of the Chiropteran Genera *Uroderma*, *Enchisthenes* and *Artibeus*," shows the old genus *Artibeus* with its six forms, as understood by Dobson, to consist of 32 forms representing three distinct genera. The number of bats known to Dobson was about 440; it is to be expected that the number recorded in the new edition of the catalogue will exceed 2,000. The significance of this increase will be understood when it is recalled that the entire number of living mammals is generally supposed to be about 5,000, a total in which the bats form about one tenth.

In general plan the present volume agrees with the original edition and with the well-known form of the British Museum "Catalogues." With the increase of fineness in discrimination, however, greater detail of treatment has become necessary. To take an example at random: in the original edition the account of *Pteropus "medius"* occupies two pages; in Mr. Andersen's volume it covers seven and a half without counting two devoted to a race not recognized by Dobson. This increase is due chiefly to the more elaborate description of characters, but it is partly the result of greater detail in the bibliographic citations: for the period covered by three lines under the name *medius* by Dobson 25 lines are here required. Perhaps the most striking

³ About 1,000 specimens in other museums were also examined. All of this outside material is carefully designated in the text or in footnotes.

special feature of the purely technical part of this work as compared with its predecessor is the different degree of importance accorded to cranial characters. For Dobson the skull scarcely existed. Thirty years ago "there were separate skulls of only half the number of species of Megachiroptera then in the collection, whereas now every species and subspecies in the museum, with one exception (*Pteropus aruensis*) is represented by at least one and often by a series of skulls." The original edition contains figures of the skulls of 17 species, of which only one is a fruit-bat. In the present volume the skulls of 47 species are figured,⁴ and detailed cranial and dental measurements are given of practically every recognized form.⁵

Another aspect in which Mr. Andersen's work differs from Dobson's is the relatively greater space allotted to speculation on such general subjects as distribution, interrelationships, the relative primitiveness or specialization of species, and the meaning of structures. The interest of the volume is thus much increased, particularly because it is here that the greatest individual differences of opinion are likely to be encountered. It is easy, for instance, to follow the author in his generic, specific and subspecific "splitting" of the *Cynopterus* group; but when he remarks of *Sphærias* (p. 673) that: "It must use its incisors in a way different from that of its relatives, as clearly shown by their remarkably proclivous position and peculiarly modified shape," he appears to offer a greater unknown quantity to explain a less. That is, until some member of this group is known to feed on other substances than fruit pulp there is no reason to believe that the exact form of the small and mechanically unimportant incisor

⁴With two exceptions the 85 illustrations are original pen drawings by Mr. A. J. Engel Terzi. Their quality leaves nothing to be desired.

⁵The fact that the tables of measurements contain maxima and minima only is one of the few details of plan open to adverse criticism. The main object of making a series of measurements of the same part in a number of individuals is to discover what is normal; we are here given the two records which are most unusual.

teeth is of consequence to the animals. Such teeth in any mammal appear to assume any form readily developed from a generalized type; and that special modes of use enter into the problem has not yet been shown, however currently it may be assumed.

From the point of view of the general reader the discussion of geographic distribution (pp. lxxv-xcii) is of unusual interest. Mr. Andersen here shows the fallacy of the popular idea that bats, having wings, roam where they will, and of the more pernicious notion that philosophizing is profitable without exact and detailed knowledge of facts.⁶ He says (pp. lxxvi-lxxviii):

The evidence afforded by the geographical distribution of bats has generally been considered of doubtful value. . . . This unwillingness or hesitation to place bats on an equal zoogeographical footing with non-flying mammalia would seem to be due, partly to the preconceived idea that owing to their power of flight bats must evidently have been able easily to spread across barriers which, in ordinary circumstances, are insuperable for wingless mammalia; partly to the fact that hitherto very often whole series of distinct forms have been concealed under one technical name. So long as (to mention only three cases among many) *Macroglossus minimus* was believed to range unchanged from the Himalayas to New Guinea, Australia, and the Solomon Islands (now two distinct genera, thirteen recognizable forms), or "*Cynopterus marginatus*" over India, Ceylon, Indo-China and Indo-Malaya (now six species, fourteen forms), or "*Rhinolophus ferrum-equinum*" uniformly over Europe, Asia and Africa (now numerous distinct forms) they were undoubtedly of questionable value as zoogeographical material. But these and similar anomalies invariably disappear as soon as modern methods of discrimination applied on vastly increased material render it possible to draw the lines of separation between the species (and their local modifications) somewhat more closely in accordance with the lines drawn by nature. The second argument referred to above, that the spreading of bats from one locality to

⁶One of the most persistent of modern zoological myths—the belief that the rabbit of Porto Santo has developed recognizable characters within historic times—arose from the failure to discriminate between the Mediterranean and central European races of a common mammal.

another must obviously have been greatly facilitated by their possession of wings, may in theory appear plausible enough, but when tested on the actual distribution of the species and subspecies it proves to be of much less importance than commonly supposed; it rests, in reality, on the confusion of two different things: the power of flight no doubt would enable a bat to spread over a much larger area than non-flying mammalia, but as a matter of fact, only in a very few cases is there any reason to believe that it has caused it to do so.¹ . . . A few of the more striking examples may be mentioned here: a species of *Pteropus* inhabits the island of Pemba, south of Zanzibar, but although the island is separated from Africa by a channel only 35-40 miles wide, not this particular species only, but the whole genus is unknown from any part of the adjacent continent;² although absent from Africa the genus *Pteropus* is distributed all over the Malagasy region,³ and each group of islands . . . has its own peculiar species, intermigration between the groups of islands is unknown; the Epomophorine section of fruit-bats is distributed over the whole of the Ethiopian region (eight genera, nineteen forms), but not a single form has spread to any island of the Malagasy region; the *Pteropus melanotus* group of [five] species is distributed over the Andamans, Nicobars, Nias, Engano and Christmas Island (south of Java), and the whole group is confined to this chain of islands, no form having spread to the neighboring Malay Peninsula or Sumatra. . . . The fruit-bat faunas of the Malay Peninsula, Sumatra and Borneo are closely interrelated, like their mammalian faunas in general, but each has

¹ The preponderance of bats over the characteristic Indo-Malayan non-volant types in the fauna of the Andaman and Nicobar Islands appears to be an instance in which wings have played a part in distribution (Miller, *Proc. U. S. Nat. Mus.*, XXIV., pp. 790-791, May 28, 1902); the presence of a slightly modified species of *Nycteris*, a characteristic American type of bat, as the only indigenous mammal of the Hawaiian Islands is probably another case of the same kind.

² Conversely, six species of European bats (*Myotis myotis*, *M. dasycneme*, *M. emarginatus*, *Pipistrellus natusii*, *Eptesicus nilssonii* and *Vesperugo murinus*, although occurring on or near the west coast from Brittany northward, are not known to have become established in England.

³ It ranges eastward "through the . . . Oriental and Australian regions to the Samoa Islands."

some distinct autochthonous forms of fruit-bats (Borneo even two autochthonous [?]¹⁰ genera), as it has of other Mammalia; the Javan mammalian fauna in general is more peculiar, both by the absence of some of the forms found in Sumatra and the Malay Peninsula, and by the greater percentage of autochthonous forms, and this is again borne out by the Megachiropterine fauna of the island . . .; the *Pteropus rayneri* group is represented probably all over the Solomon Islands, but it has differentiated into five distinct species, one in the Bougainville group, a second on Villa Lavella, a third in the New Georgia group, a fourth on Guadalcanar and a fifth on San Cristobal. This . . . tends to show that the present distribution of the Megachiroptera has not been influenced to any great, and as a rule not even to any appreciable, extent by their power of flight; if it had, the fruit-bat fauna of one group of islands could not, so commonly as is actually the case, differ from that of a neighboring group or continent, and the tendency to differentiation of insular species or forms would have been neutralized by the free intercourse between neighboring faunas.

GERRIT S. MILLER

SPECIAL ARTICLES

THE PRODUCTION OF SPERM ISO-AGGLUTININS

BY OVA

I. If one allows unfertilized eggs of *Arbacia* to stand in a quantity of sea-water that does not exceed about ten times the volume of the eggs, the sea-water soon becomes perceptibly tinged with the red coloring matter of the eggs. If now a few drops of such supernatant sea-water be added to 2 or 3 c.c. of a milky suspension of active sperm of the same species, a strong agglutination of the sperms immediately ensues, producing sperm-masses easily visible to the naked eye. In the course of three to five minutes reversal takes place, the masses become converted into their constituent cells, and considerable activity may be observed after the reversal on microscopical examination. The substance which produces this phenomenon may be called a sperm agglutinin, and since it is produced by the same species, an iso-agglutinin.

This basic phenomenon was studied in three

¹⁰ Further exploration will probably show that both occur on the peninsula or in Sumatra.